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ACOUSTICAL GYPSUM BOARD PANEL AND METHOD OF MAKING IT

BACKGROUND

This application relates to a gypsum board panel having improved acoustical properties. More specifically, it relates to a gypsum board panel that includes lightweight aggregate having a specific particle size distribution. The board is manufactured on a high speed line similar to gypsum wallboard.

Acoustical or ceiling panels are well known for providing a finished appearance to a ceiling area and also providing sound absorbency where needed. Ideally, the panels combine acoustic absorbency with durability for long life. Mineral wool is commonly used because it provides a porous fibrous structure for absorbing sound. Other common materials used in the manufacture of ceiling panels include fiberglass, expanded perlite, clay, gypsum, stucco, calcium carbonate and paper fiber.

Many ceiling panels are made in a manner similar to the process used to make paper or fiberboard. In this water-felting process, an aqueous dispersion of the fibers, aggregates, binders, and other additives is dispensed onto a porous surface or wire where the furnish is dewatered, both by gravity and by vacuum suction. The wet mat is dried in a convection oven, fissured and/or perforated to impart acoustical absorbency and then cut into desired lengths. If desired, the surface is painted to produce a finished panel. An example of such a panel is the AURATONE® ceiling tile made by USG Interiors (Chicago, Ill.).

Another process for making ceiling panels is by casting, as described in U.S. Pat. No. 1,769,519. A composition of mineral wool fibers, fillers, colorants, a binder such as cooked starch and water is placed in trays covered with paper or paper-backed foil. The composition is then screeded with a forming plate to the desired thickness. A decorative surface, such as an embossed pattern, is obtainable by imparting a pattern into the surface of the cast material by use of a screed bar or a patterned roll. ACOUSTONE® ceiling tile by USG Interiors (Chicago, Ill.) is an example of such a cast panel.

Both of these methods of making ceiling panels are relatively expensive because they utilize large amounts of water and energy. Hygroscopic binders, such as paper or starch, result in panels that are susceptible to sag. Sagging of the panel can be accentuated when the panel supports insulation or other loads or when subjected to high levels of humidity and temperature. The products require additional process steps, such as perforation, that increase the manufacturing cost. Additionally, these panels have very limited green strength prior to pressing or drying of the panel. This feature makes it difficult to manufacture the panels on a high-speed line, such as that used to make gypsum board panels.

Gypsum panels are less prone to sag and are manufactured efficiently in a high-speed process. However, gypsum is heavy and it lacks acoustical absorbency. It is currently adaptable for use as acoustical ceiling panels by including holes in the panels and positioning a sound-absorbing backing on the back of the perforated panel. While the holes provide some weight reduction and sound absorbance, they are not accepted by consumers as being aesthetically pleasing.

Two patents U.S. Pat. Nos. 6,387,172 and 6,481,171 have described acoustic gypsum compositions. Both describe the use of both fibrous calcined gypsum and non-fibrous calcined gypsum in gypsum products. Another gypsum panel having an acoustical layer is described in U.S. Patent Publication No.

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2004/0231916. One embodiment of this panel has an acoustical layer of foamed gypsum formed on denser gypsum material for strength.

SUMMARY OF THE INVENTION

These and other problems are solved by the gypsum products of the present invention that can be made on a high-speed manufacturing line, yet have improved sound-absorption properties. More specifically, the gypsum products of this invention have a core of a particular structure that does not require perforation or specific facing materials to achieve acoustical absorption.

The acoustical product of the present invention includes a matrix of calcium sulfate dihydrate crystals and expanded perlite distributed throughout the matrix. The expanded perlite has a particle size distribution with at least 10% of the perlite having a particle diameter of 700 microns or more, and the amount of expanded perlite to calcium sulfate dihydrate is about 35% to about 75% by weight, based upon the dry weight of the calcium sulfate dihydrate. A dispersing agent and glass fibers having a particle length of about ¼ inch to about 1 inch are optionally dispersed throughout the gypsum matrix.

Products of this invention are advantageous because they are lightweight, yet provide improved sound absorbance. Sound absorbance, as measured by noise reduction coefficient (NRC), values of 0.70 are attainable using this formulation. Panels are light enough for use as ceiling panels, yet only a minimal reduction in nail pull strength results compared to panels using a conventional perlite particle size distribution. Light-weight panels reduce fatigue in the installers, allowing them to accomplish more in a given time period and reducing the cost of installation.

Further, these products can be manufactured on high-speed gypsum board manufacturing lines. Unlike fiber-board products that are made in individual molds, the present products can be made as a continuous strip, then cut into desired length and separated prior to entering the kiln. Because the product develops sufficient green strength prior to entering the kiln, the product can be handled without pressing. The improved green strength of this product also allows its manufacture without the need for a plurality of facing materials types.

The addition of foam to the gypsum slurry reduces its density, improves its acoustic property and maintains its natural slurry flowability. The foamed slurry spreads evenly over the forming table or the facing material with little or no spreading device required. Energy use is minimized and the manufacturing process is reduced by limiting the number of steps. Foam addition also creates foam voids where the gypsum matrix forms around a foam bubble.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a graph of the particle size distributions of three expanded perlites used in Example 1.

DETAILED DESCRIPTION OF THE INVENTION

An acoustical product having improved sound-absorbing properties is made. Expanded perlite having a particular particle size distribution is held in a gypsum matrix to provide improved sound absorbance. Unless otherwise noted, concentrations used in this description refer to percentages by weight based on the dry weight of the calcium sulfate hemihydrate.